

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. An uncycled electrode for a non-aqueous lithium electrochemical cell, comprising a lithium metal oxide having the formula $\text{Li}_{(2+2x)/(2+x)}\text{M}'_{2x/(2+x)}\text{M}_{(2-2x)/(2+x)}\text{O}_{2-\delta}$, in which $0 \leq x < 1$ and δ is less than 0.2, and in which M is a non-lithium metal ion with an average trivalent oxidation state selected from two or more of the first row transition metals or lighter metal elements in the periodic table, and M' is one or more ions with an average tetravalent oxidation state selected from the first and second row transition metal elements and Sn.
2. The electrode of claim 1, where δ is less than 0.1.
3. The electrode of claim 1, in which M is selected from Co, Ni, Mn, Ti, Mg and Al, and M' is selected from Ti, Mn, Zr, Ru and Sn.
4. The electrode of claim 3, in which M is selected from Co, Ni and Mn, and M' is selected from Ti and Mn.
5. The electrode of claim 4, in which M is selected from Co, Ni and Mn, and M' is selected from Mn.
6. The electrode of claim 5, in which M is selected from Ni and Mn, and M' is selected from Mn.
7. The electrode of claim 1, in which M is selected from Co, Ni and Mn and $x=0$.
8. An electrode of claim 1, in which the Li^+ ions are partially exchanged by H^+ ions.
9. An electrode for a non-aqueous lithium cell, comprising a lithium metal oxide having the formula $x\text{Li}_2\text{M}'\text{O}_3 \bullet (1-x)\text{LiMO}_2$, in which $0 \leq x < 1$, and in which M is a non-lithium metal ion with an average trivalent oxidation state selected from two or more first-row transition metals

or lighter metal elements in the periodic table, and M' is one or more ions with an average tetravalent oxidation state selected from the first- and second-row transition metal elements and Sn, the electrodes being preconditioned in a proton-containing medium with a pH<7.0 to yield $x\text{Li}_{2-y}\text{H}_y\text{O} \bullet x\text{M}'\text{O}_2 \bullet (1-x)\text{Li}_{1-z}\text{H}_z\text{MO}_2$ compounds in which $0 < x < 1$, $0 < y < 1$ and $0 < z < 1$.

10. The electrode of claim 9, in which M is selected from Co, Ni, Mn, Ti, Mg and Al, and M' is selected from Ti, Mn, Zr, Ru and Sn.

11. The electrode of claim 10, in which M is selected from Co, Ni and Mn, and M' is selected from Ti and Mn.

12. The electrode of claim 11, in which M is selected from Co, Ni and Mn, and M' is selected from Mn.

13. The electrode of claim 12, in which M is selected from Ni and Mn, and M' is selected from Mn.

14. A method of synthesizing the uncycled electrode of claim 1 in which the $x\text{Li}_2\text{M}'\text{O}_3 \bullet (1-x)\text{LiMO}_2$ electrode is subjected to a reducing environment at a temperature between about 150 °C and about 1000 °C.

15. A method according to claim 14 in which the reducing environment consists of one or more of ammonia gas, hydrogen gas, nitrogen gas and carbon.

16. A method according to claim 15, in which the reducing environment is ammonia gas.

17. A method according to claim 14, in which the reducing temperature is between 150 °C and 600 °C.

18. A method according to claim 17, in which the reducing temperature is between 150 °C and 400 °C.
19. An electrode made according to the method of claim 14.
20. A method of synthesizing the electrode of claim 9 by subjecting the $x\text{Li}_2\text{M}'\text{O}_3\bullet(1-x)\text{LiMO}_2$ electrode to a proton-containing medium with $\text{pH} < 7.0$, and thereafter heating the electrode below 500 °C for less than 24 hours.
21. A method according to claim 20 in which the electrode is heated below 400 °C.
22. A method according to claim 20 in which the proton-containing medium consists of de-ionized water, nitric acid, acetic acid, or hydrochloric acid.
23. An electrode made according to the method of claim 20.
24. A non-aqueous lithium electrochemical cell comprising a negative electrode, an electrolyte and an uncycled positive electrode having a lithium metal oxide having the formula $\text{Li}_{(2+2x)/(2+x)}\text{M}'_{2x/(2+x)}\text{M}_{(2-2x)/(2+x)}\text{O}_{2-\delta}$, in which $0 \leq x < 1$ and δ is less than 0.2, and in which M is a non-lithium metal ion with an average trivalent oxidation state selected from two or more of the first row transition metals or lighter metal elements in the periodic table, and M' is one or more ions with an average tetravalent oxidation state selected from the first and second row transition metal elements and Sn.
25. A non-aqueous lithium electrochemical cell comprising a negative electrode, an electrolyte and an uncycled positive electrode having a lithium metal oxide having the formula $x\text{Li}_2\text{M}'\text{O}_3\bullet(1-x)\text{LiMO}_2$, in which $0 \leq x < 1$, and in which M is a non-lithium metal ion with an average trivalent oxidation state selected from two or more first-row transition metals or lighter metal elements in the periodic table, and M' is one or more ions with an average tetravalent

oxidation state selected from the first- and second-row transition metal elements and Sn, the electrodes being preconditioned in a proton-containing medium with a pH<7.0 to yield $x\text{Li}_{2-y}\text{H}_y\text{O}\bullet x\text{M}'\text{O}_2\bullet(1-x)\text{Li}_{1-z}\text{H}_z\text{MO}_2$ compounds in which $0 < x < 1$, $0 < y < 1$ and $0 < z < 1$.

26. A non-aqueous lithium battery comprising a plurality of electrically connected electrochemical cells, each cell having a negative electrode, an electrolyte and an uncycled positive electrode comprising a lithium metal oxide having the formula $\text{Li}_{(2+2x)/(2+x)}\text{M}'_{2x/(2+x)}\text{M}_{(2-2x)/(2+x)}\text{O}_{2-\delta}$, in which $0 \leq x < 1$ and δ is less than 0.2, and in which M is a non-lithium metal ion with an average trivalent oxidation state selected from two or more of the first row transition metals or lighter metal elements in the periodic table, and M' is one or more ions with an average tetravalent oxidation state selected from the first and second row transition metal elements and Sn.

27. A non-aqueous lithium battery comprising a plurality of electrically connected electrochemical cells, each cell having a negative electrode, an electrolyte and an uncycled positive electrode comprising a lithium metal oxide having the formula $x\text{Li}_2\text{M}'\text{O}_3\bullet(1-x)\text{LiMO}_2$, in which $0 \leq x < 1$, and in which M is a non-lithium metal ion with an average trivalent oxidation state selected from two or more first-row transition metals or lighter metal elements in the periodic table, and M' is one or more ions with an average tetravalent oxidation state selected from the first- and second-row transition metal elements and Sn, the electrodes being preconditioned in a proton-containing medium with a pH<7.0 to yield $x\text{Li}_{2-y}\text{H}_y\text{O}\bullet x\text{M}'\text{O}_2\bullet(1-x)\text{Li}_{1-z}\text{H}_z\text{MO}_2$ compounds in which $0 < x < 1$, $0 < y < 1$ and $0 < z < 1$.